SPATIAL ALLOCATION AND ENVIRONMENTAL BENEFITS: THE IMPACTS OF THE CONSERVATION RESERVE PROGRAM IN TEXAS COUNTY OKLAHOMA

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USDA's Conservation Reserve Program

- Voluntary program initiated in 1985
- Landowners encouraged to retire highly erodible lands for 10-15 years
- Environmental Benefits:
  - Soil and water quality
  - Wildlife
  - Farm sustainability

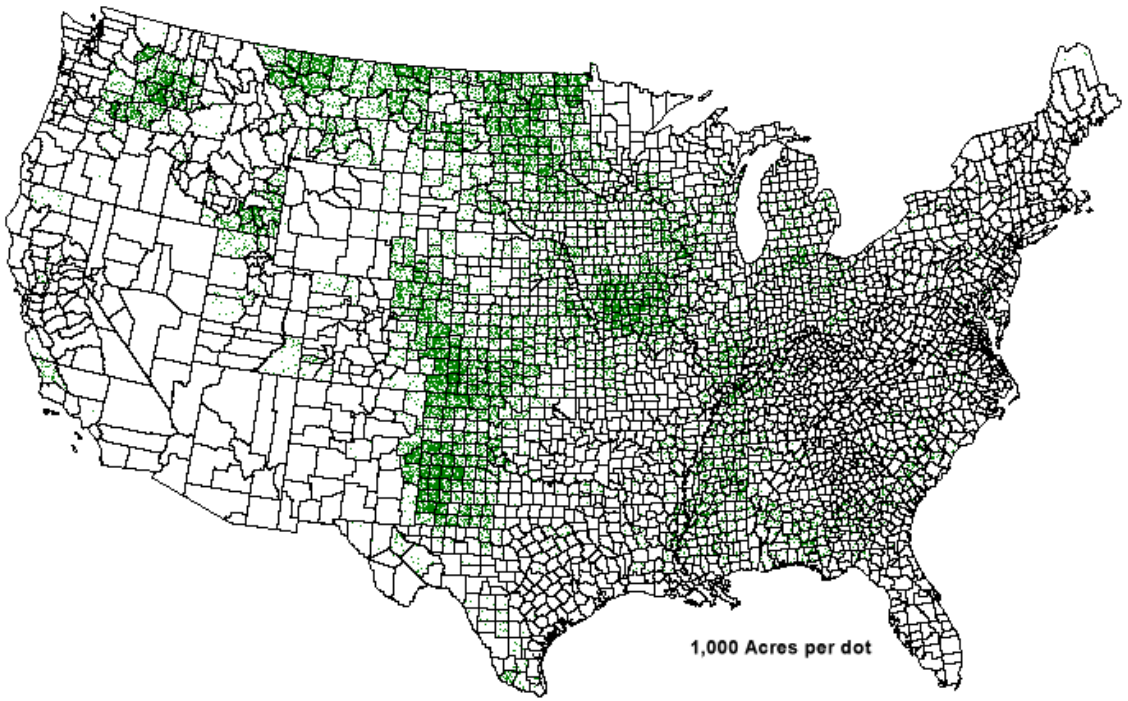
Project Goal and Objectives

To evaluate the potential environmental impacts of the CRP in Texas County, Oklahoma

- changes in soil and water quality
- benefits of CRP for wildlife habitat

Overall: Develop a CRP-DSS aimed at planning and Managing CRP

CRP acreage



(USDA 2000)

- National:

33.47 million acres

- Oklahoma:

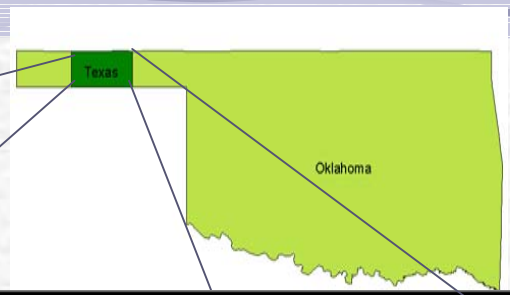
1.04 million acres

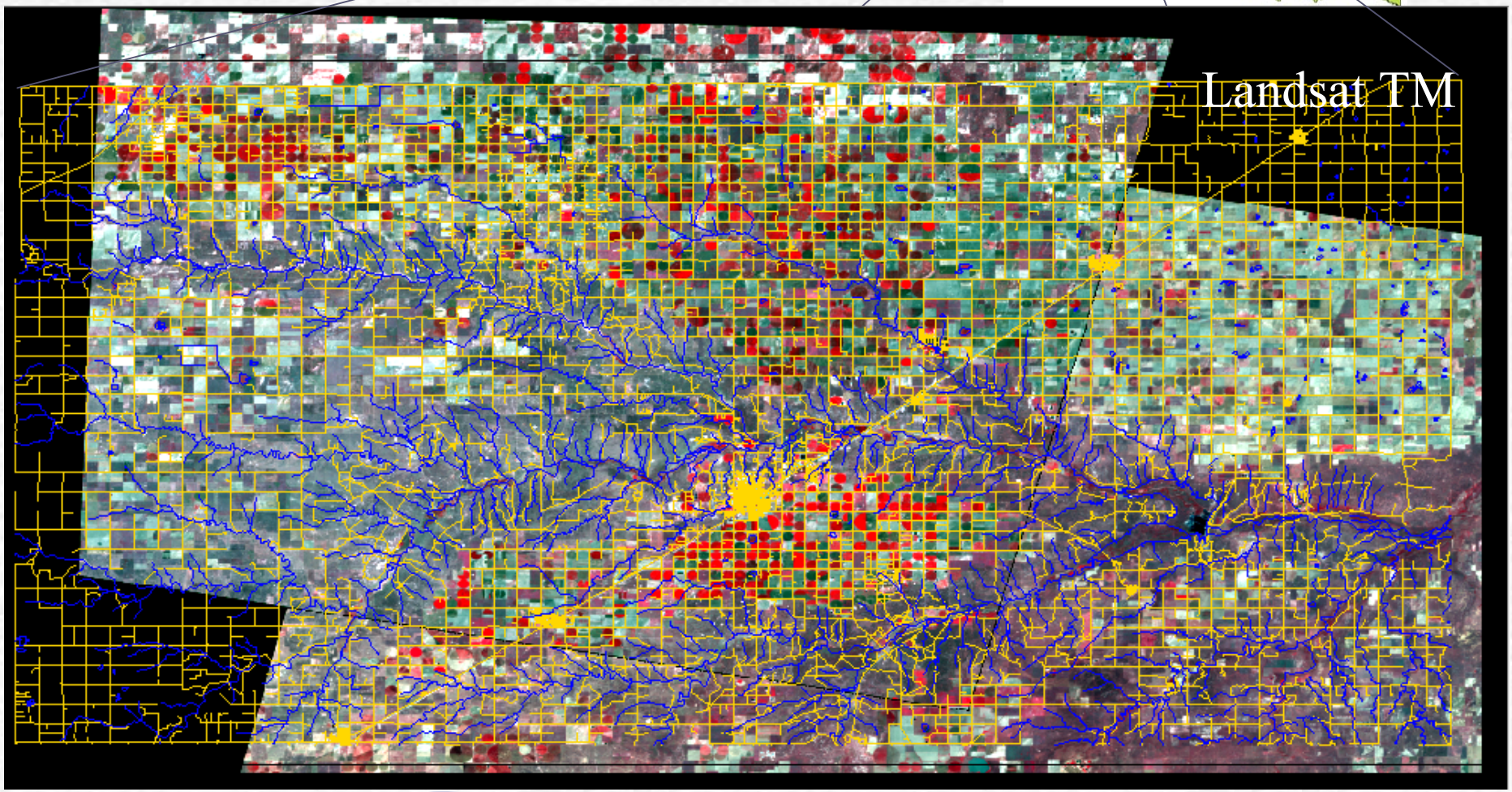
- Texas County,OK

218, 283 acres

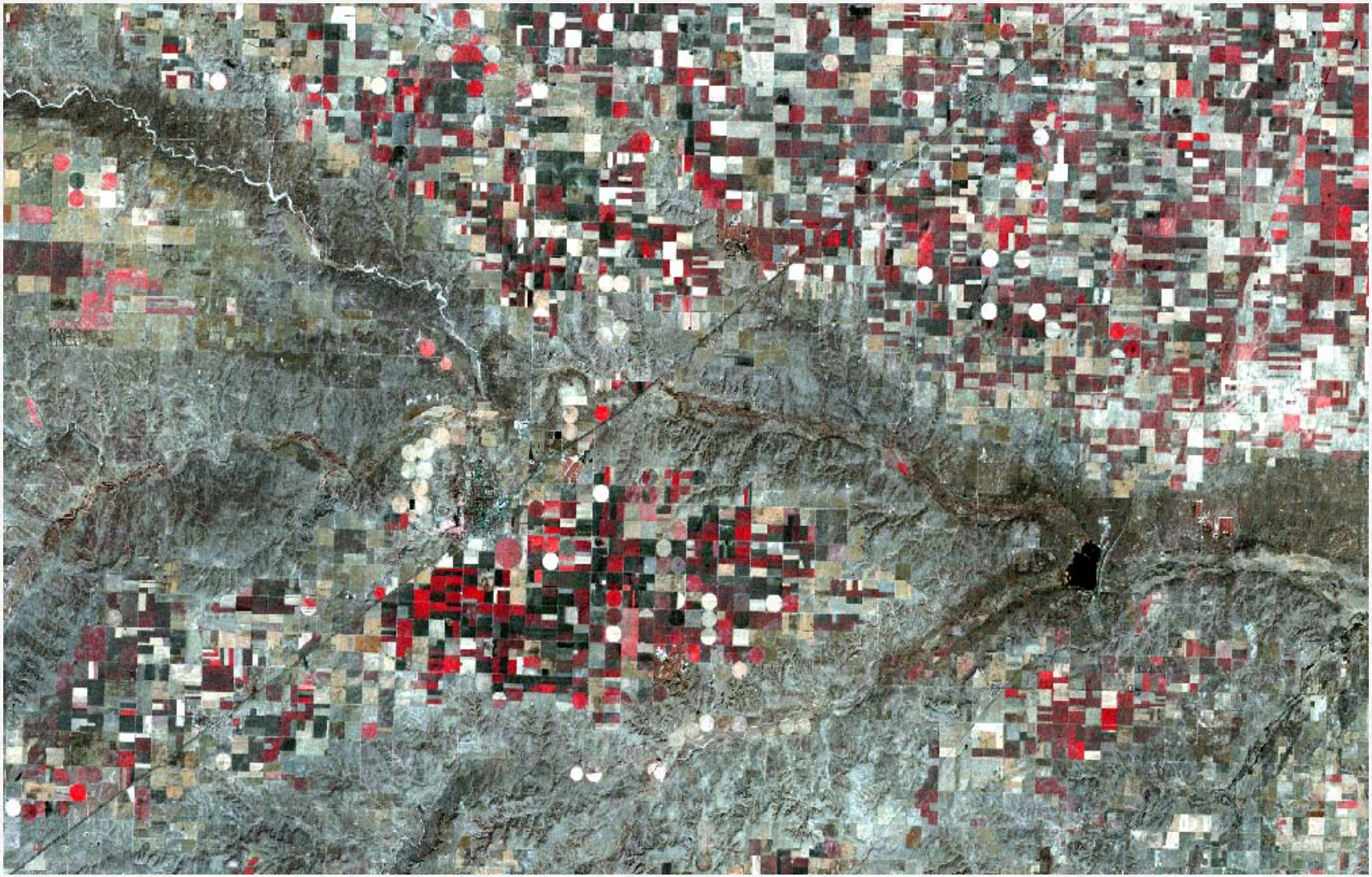
Study Area: Texas County, OK

Ranks first in CRP enrollments for Oklahoma
(218,304 acres as of July 2003)

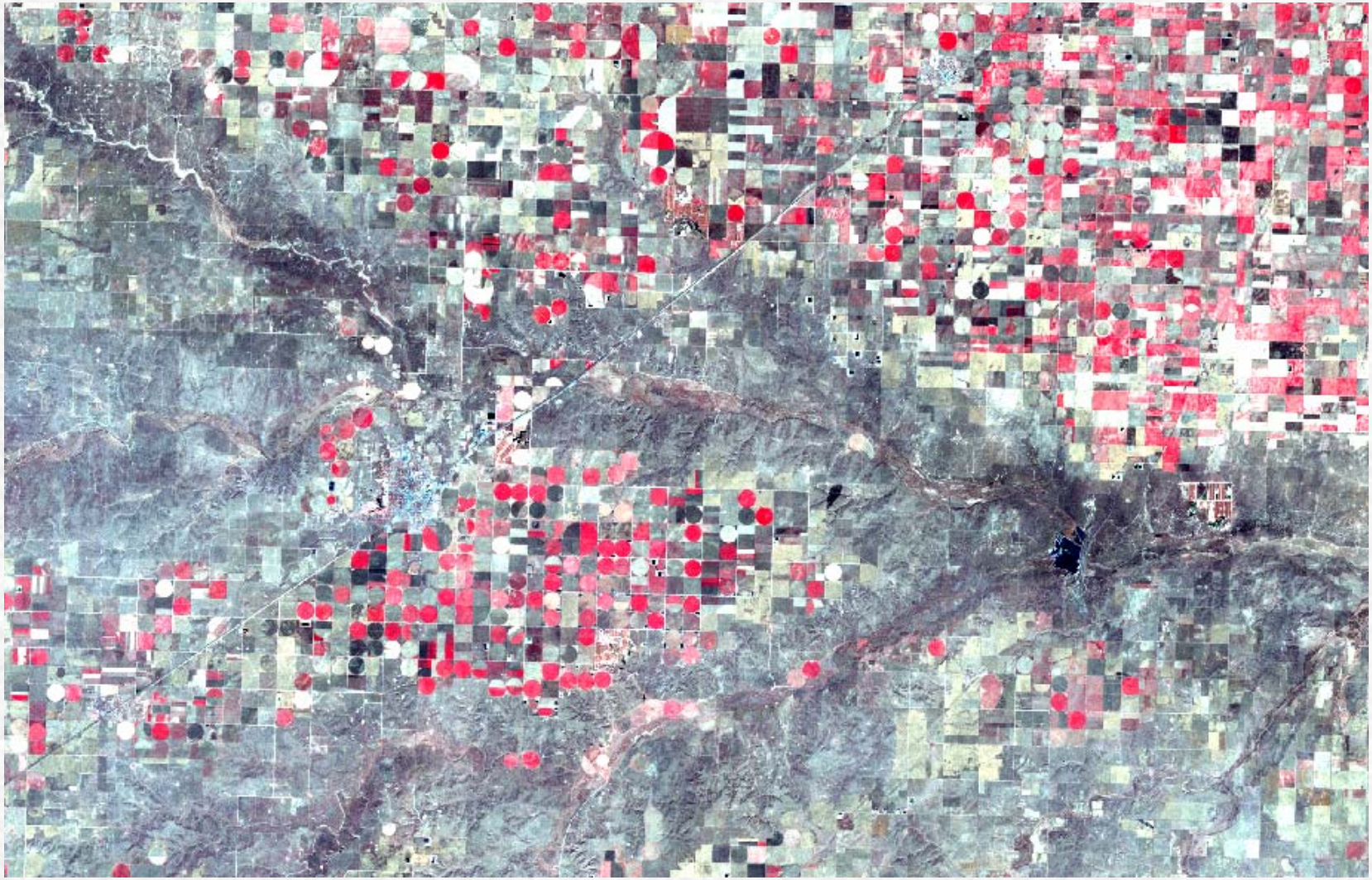




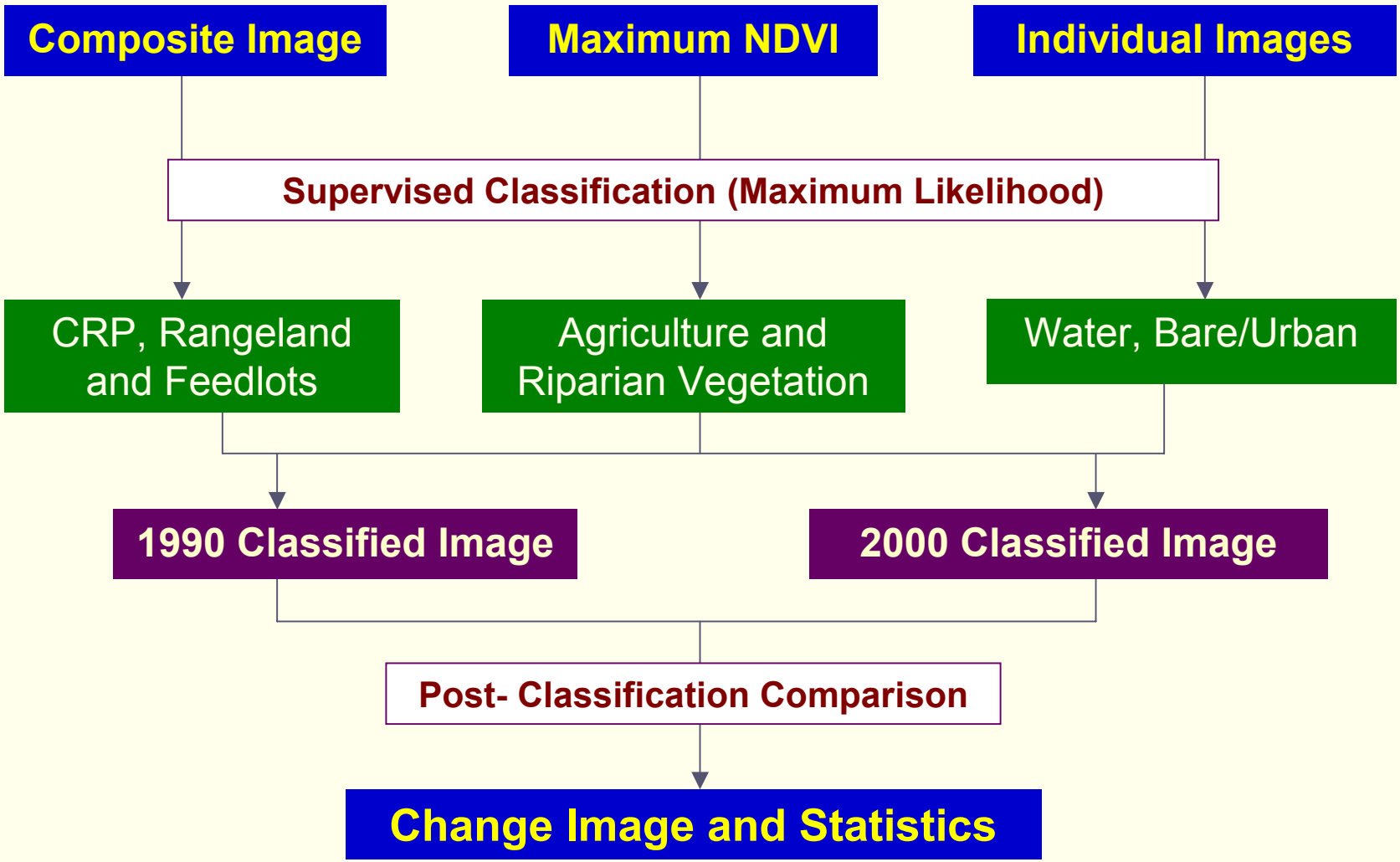
Landsat 5 (TM) 1990 January Scene



Landsat 7 (ETM+) 2000 January Scene

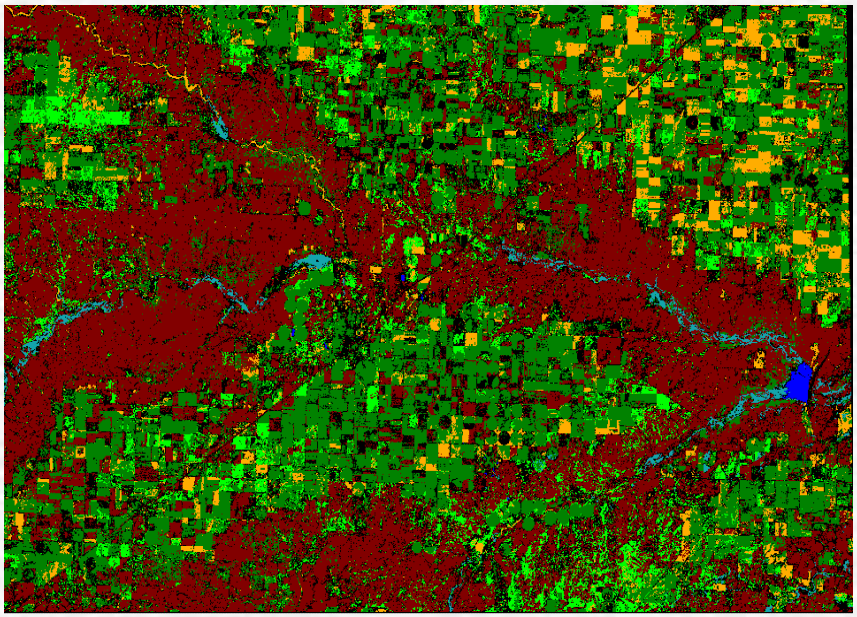


Flow chart of the Image Classification procedure

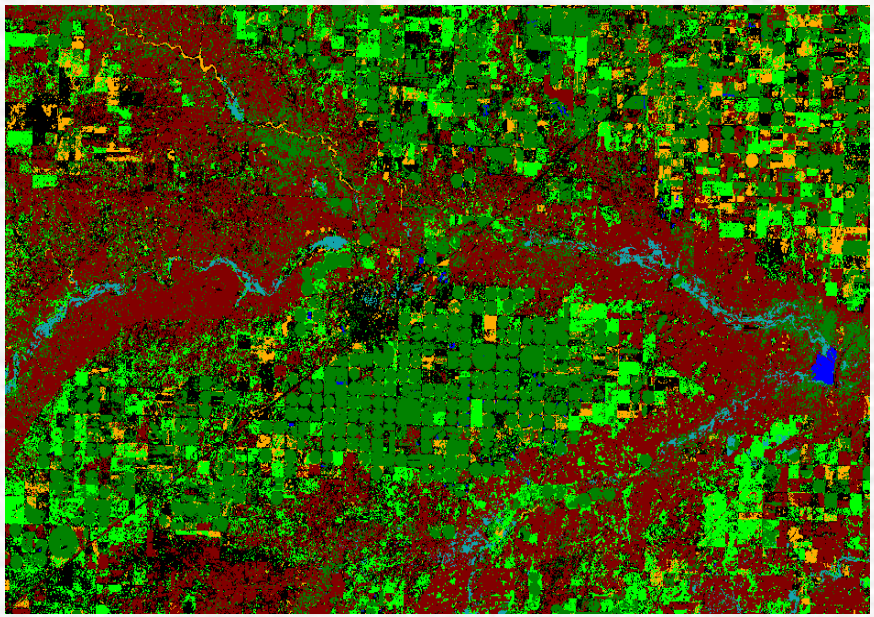


CRP Mapping

1990

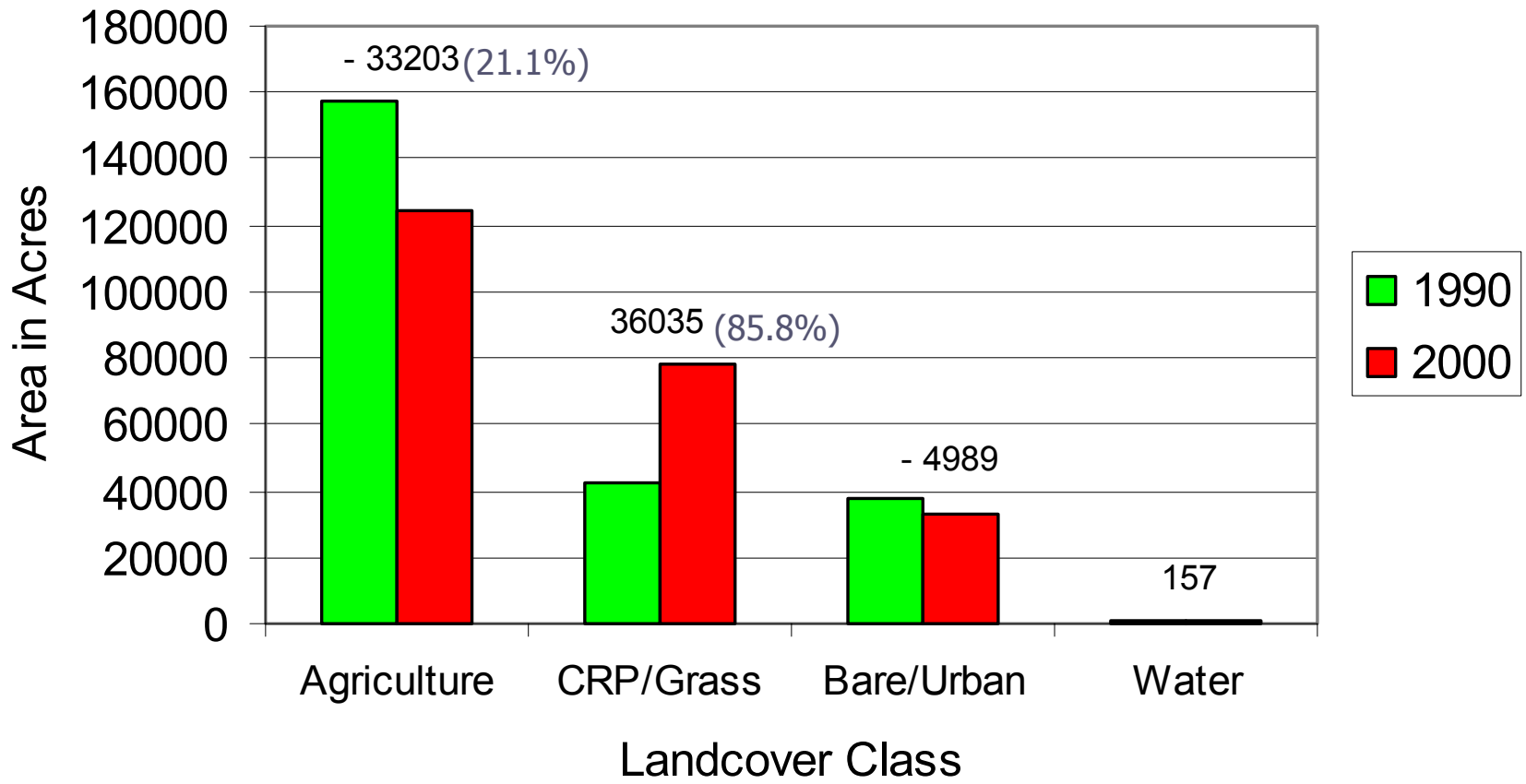


2000



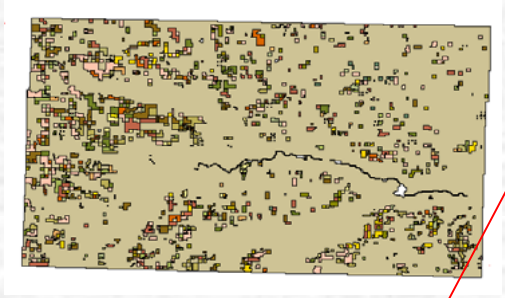
Agriculture
Bare / Urban
Cattle Feedlots
CRP / Grass
Water
Riparian Veg
Rangeland/ Wet Soil

Comparison of area under different classes in 1990 and 2000

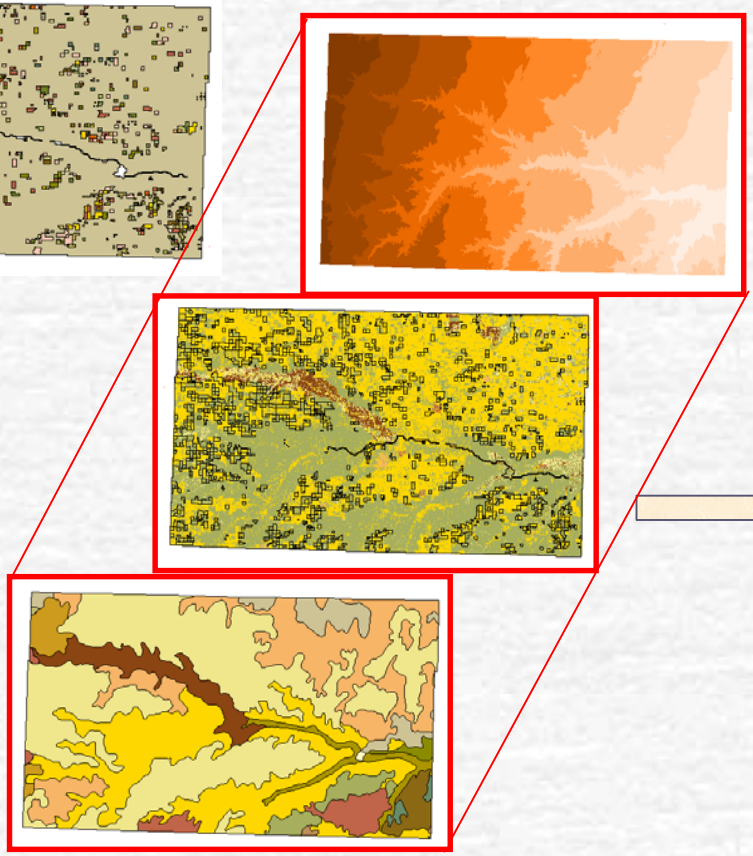


Spatial Modeling using Soil and Water Assessment Tool (SWAT)

CRP sites

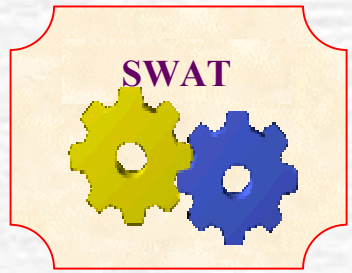


SWAT INPUT SPATIAL DATA

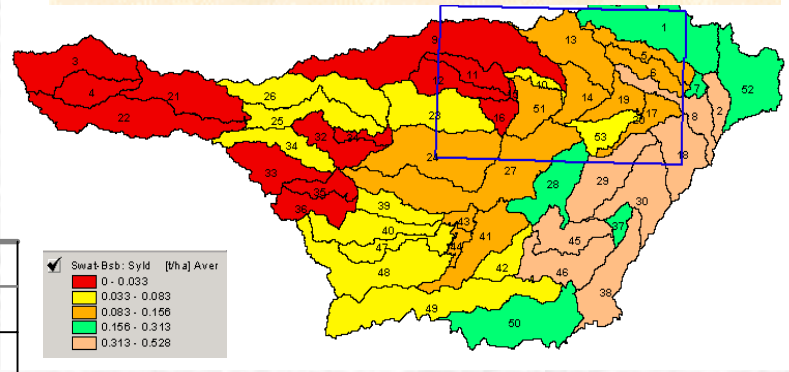


SWAT

- Developed by USDA-ARS
- Simulates the long-term effects of management decisions on water, sediment, nutrient and pesticide yields with reasonable accuracy on large, ungaged river basins.

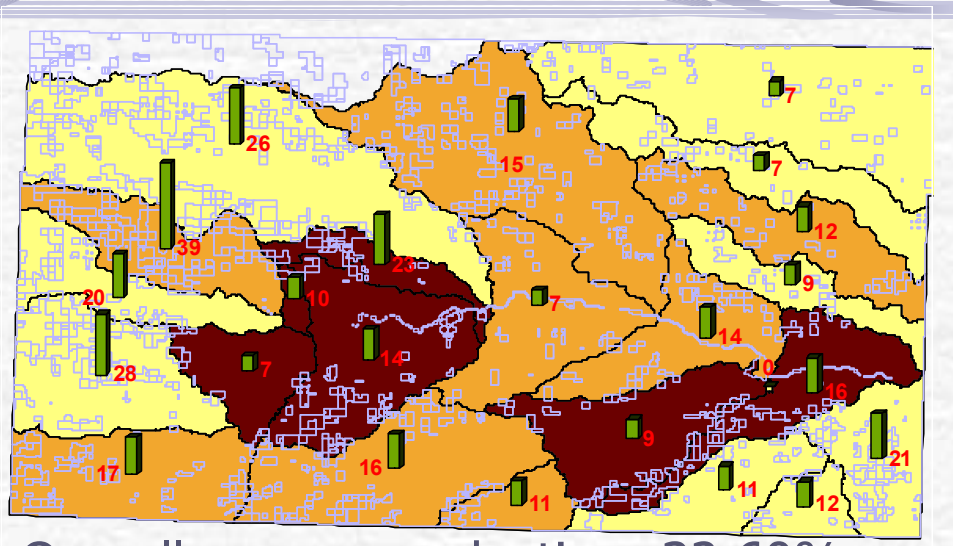


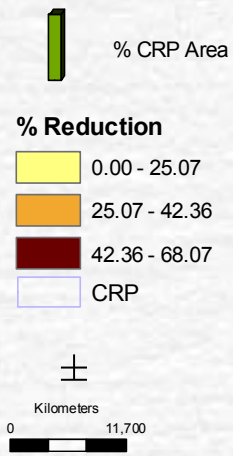
SOIL LOSS IN MIDDLE BEAVER RIVER BASIN



	Relative Error %		R^2		Nash-Sutcliffe Coefficient	
	Calibration	Validation	Calibration	Validation	Calibration	Validation
Guymon	9	21	0.65	0.62	0.64	0.59
Beaver	12	3	0.61	0.66	0.55	0.53

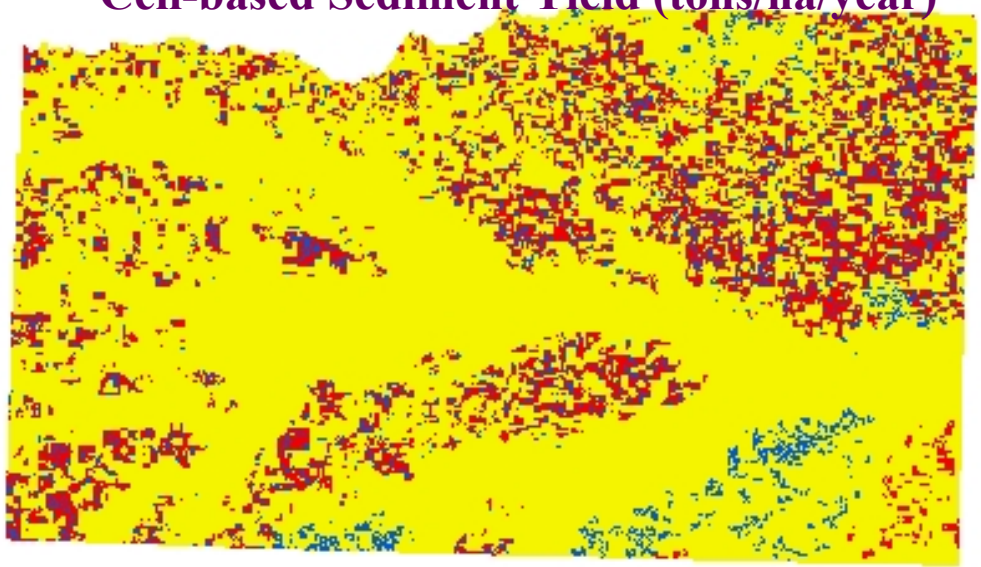
CRP and Sediment Yield



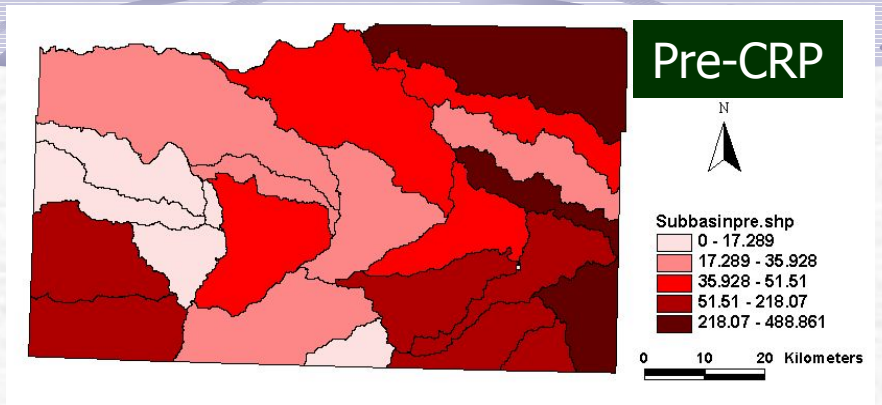


Overall average reduction: 32.60%

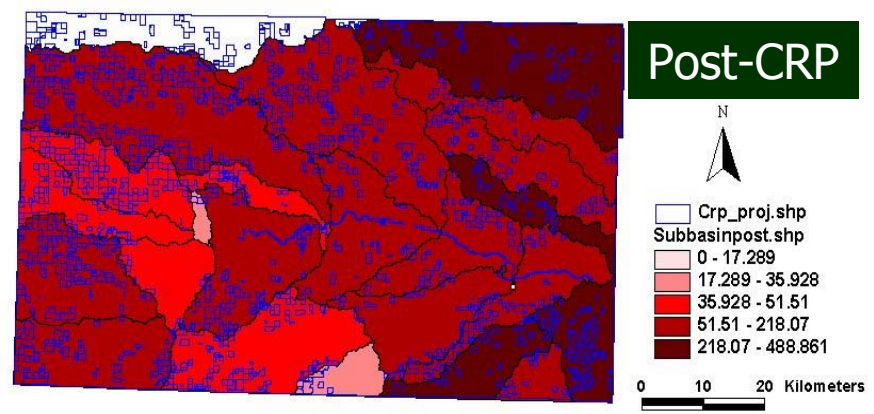
Cell-based Sediment Yield (tons/ha/year)



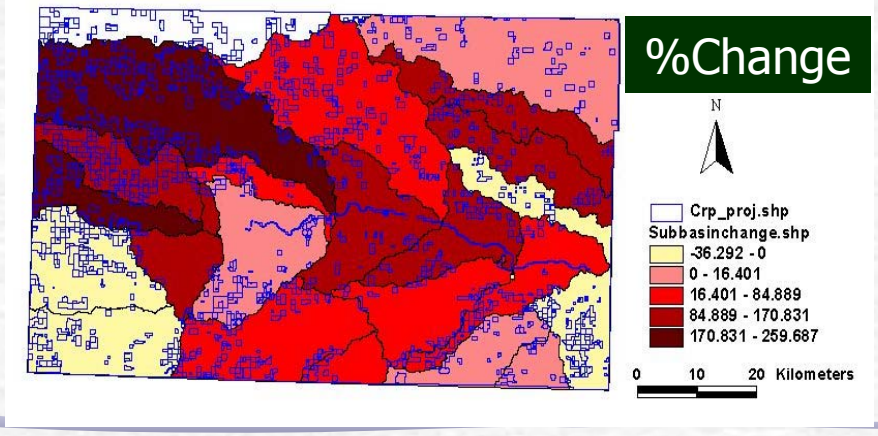
CRP and GW Recharge
(Average Annual recharge (mm))



Decreased in center and west portion of county

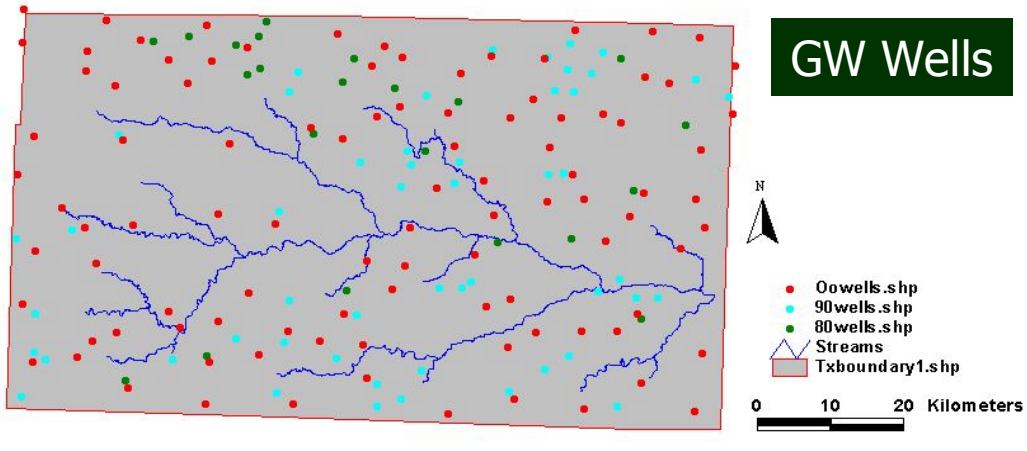


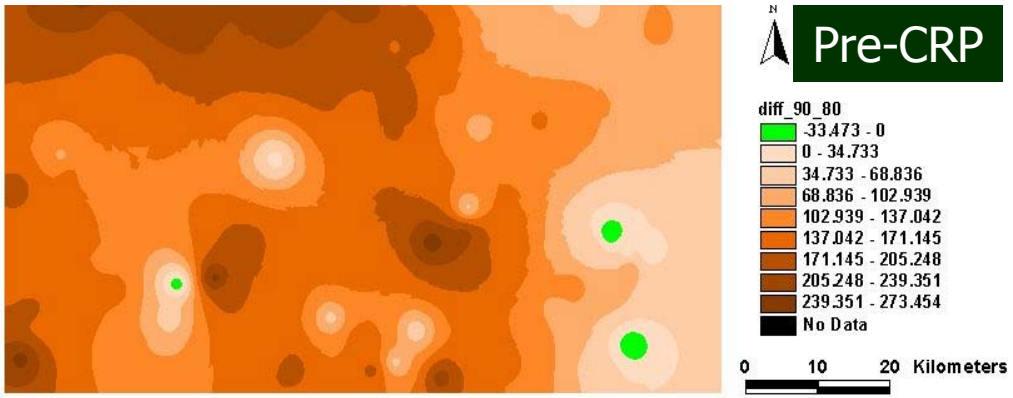
Increased in center and west portion of county

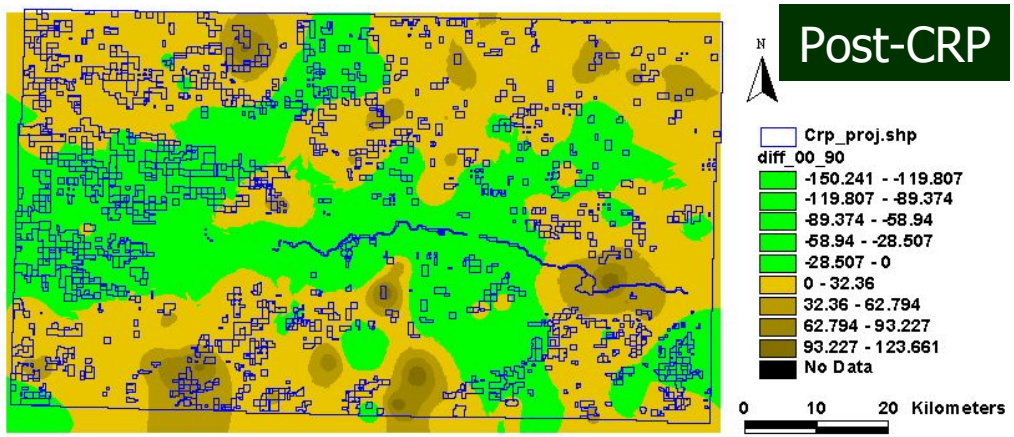


Overall change in Annual recharge (mm) in county = 18%

CRP and GW Depth (ft)



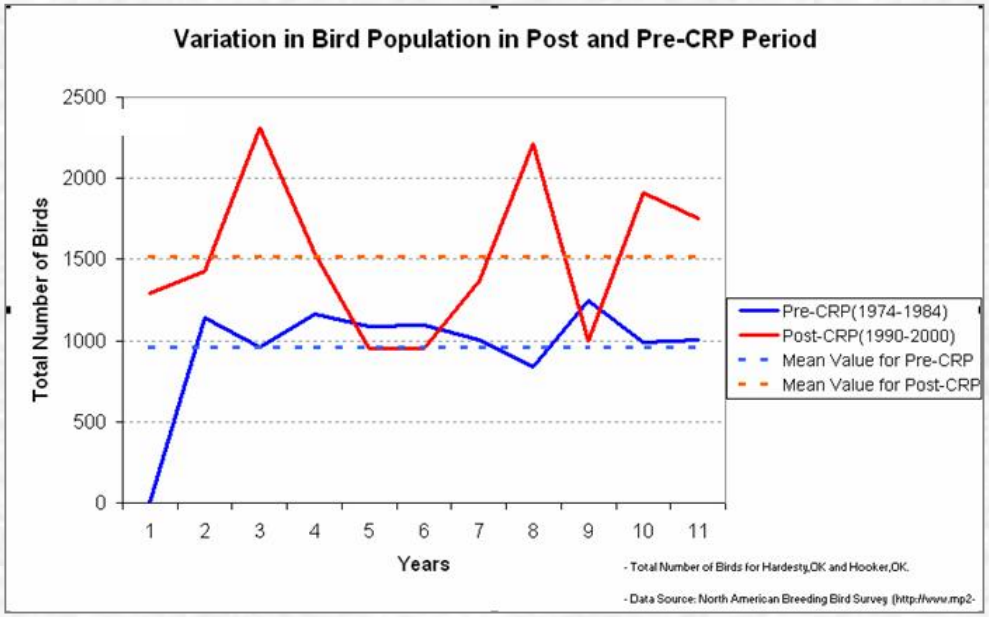




Overall, significant decline in the county

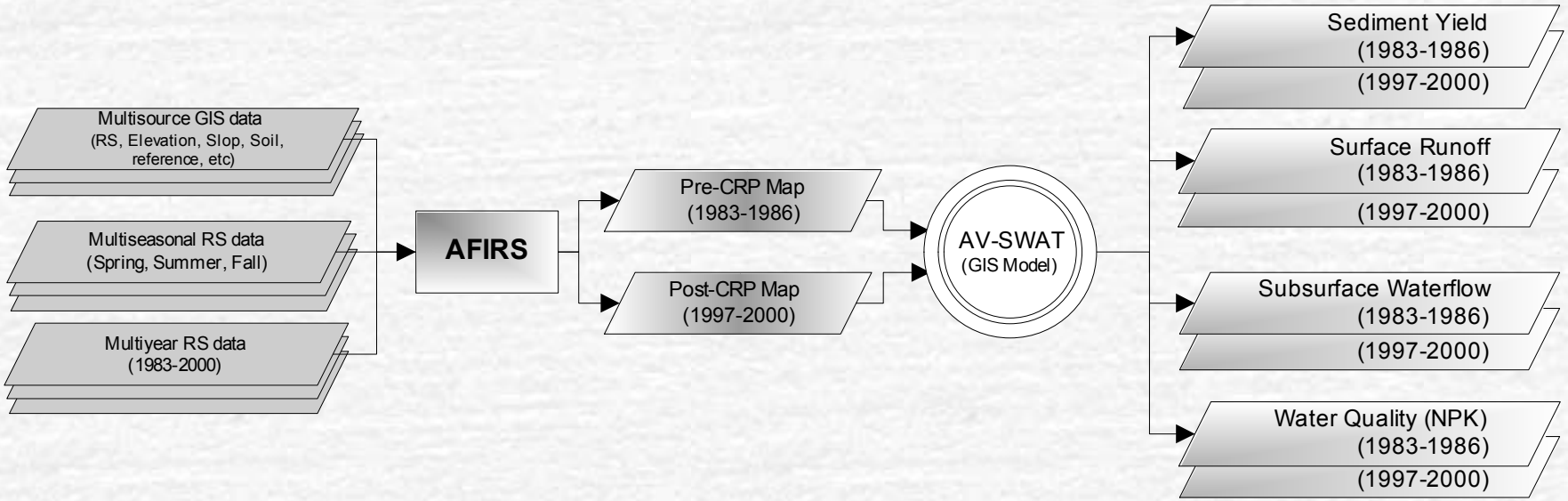
Overall, significant improvement in the county

CRP and Landscape Metrics

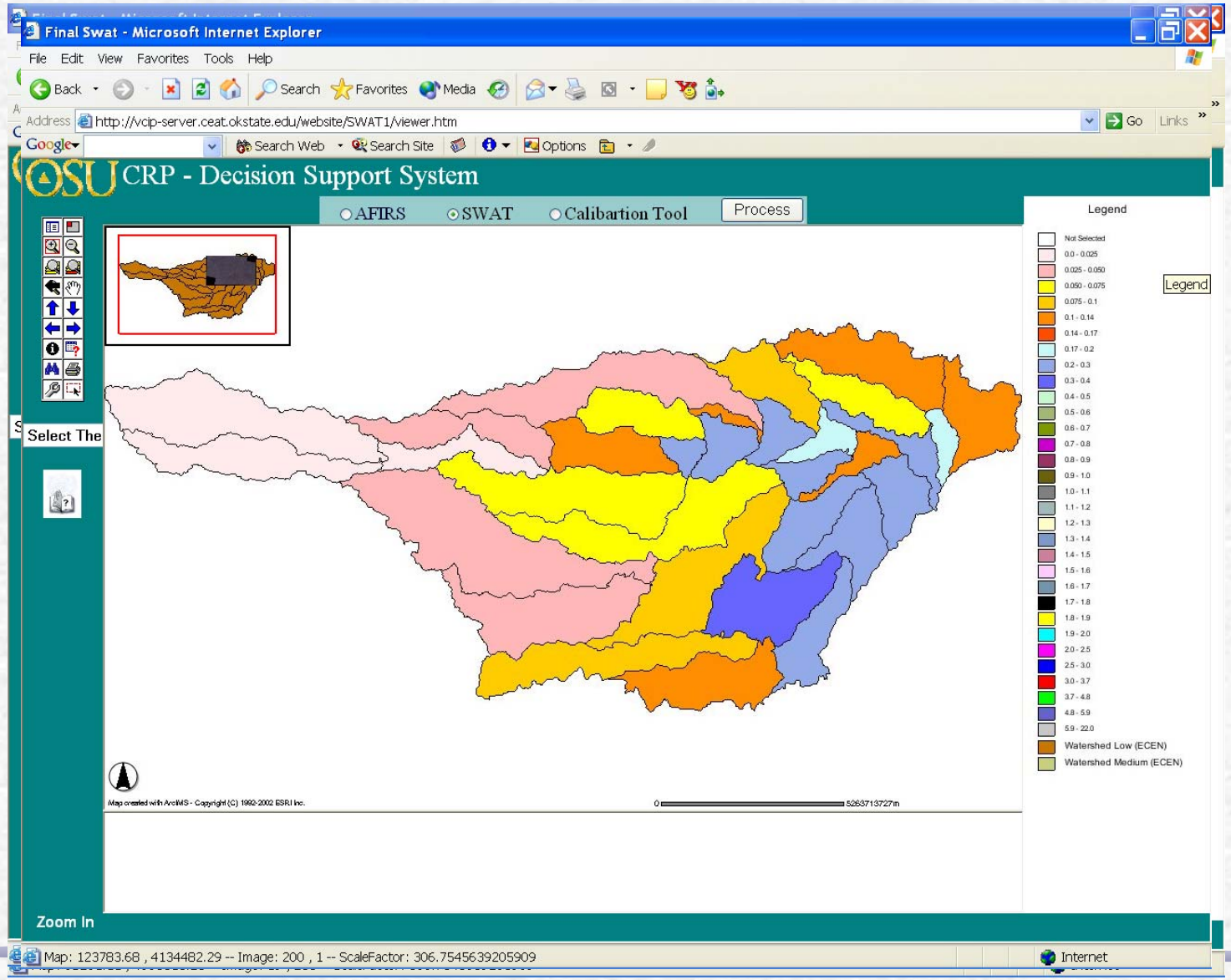


Patch Metric	Pre-CRP	Post-CRP
Grassland area (ha)	315,038	348,999
Percent area in grassland	62%	69%
Grassland perimeter (km)	18,912.4	17,020.1
Number of patches	12,754	9,666
Mean patch size (ha)	24.7	36.11
Edge density (m/ha)	37.43	33.68
Mean shape index	1.28	1.26
Area-weighted MSI	51.64	47.41
Mean nearest neighbor distance (m)	55.04	52.2
Mean proximity index (m)	874,716	1,176,176

CRP Mapping and Modeling



CRP-DSS Interface



Conclusions

- Significant increase (85.8%) in CRP tracts; decrease in agriculture (21.1%)
- About 32.60% overall reduction in sediment yield
- Increase in CRP favors landscape function (ecological)
- CRP and Groundwater:
  - Recharge – increased about 18% overall (1990-2000)
  - GW Depth (Difference between 1980-1990 and 90-2000)
    - decline rate of GW depth decreased
    - Increase in groundwater levels